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(54) **IMAGE STABILIZER AND IMAGE-SHAKE CORRECTING METHOD**

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CPC **G03B 5/00** (2013.01); **G02B 27/646**
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2217/005 (2013.01)

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G03B 17/00; G03B 13/34

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See application file for complete search history.

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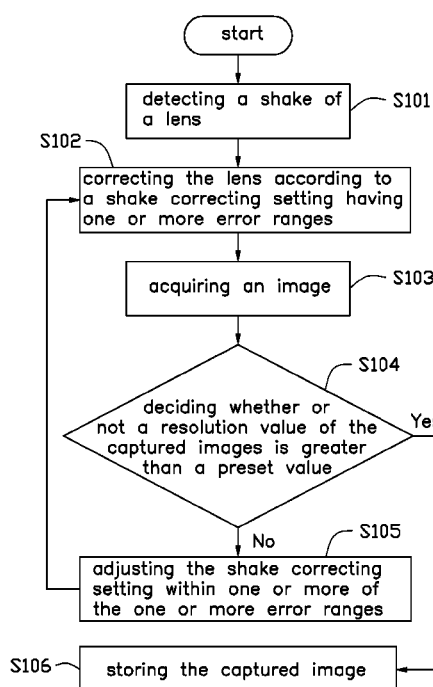
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(57) **ABSTRACT**

An exemplary image stabilizer includes a shaking sensor, a control module, a driving module, an image module, and a data adjusting module. The shaking sensor detects a shake of a lens associated with the image stabilizer. The control module stores a shake correcting setting having one or more error ranges. The driving module is controlled by the control module to move the lens according to the shake correcting setting. The image module captures an image through the corrected lens. The data adjusting module adjusts the shake correcting setting within one or more of the error ranges when a resolution value of the captured image is lower than a preset reference value.

9 Claims, 2 Drawing Sheets



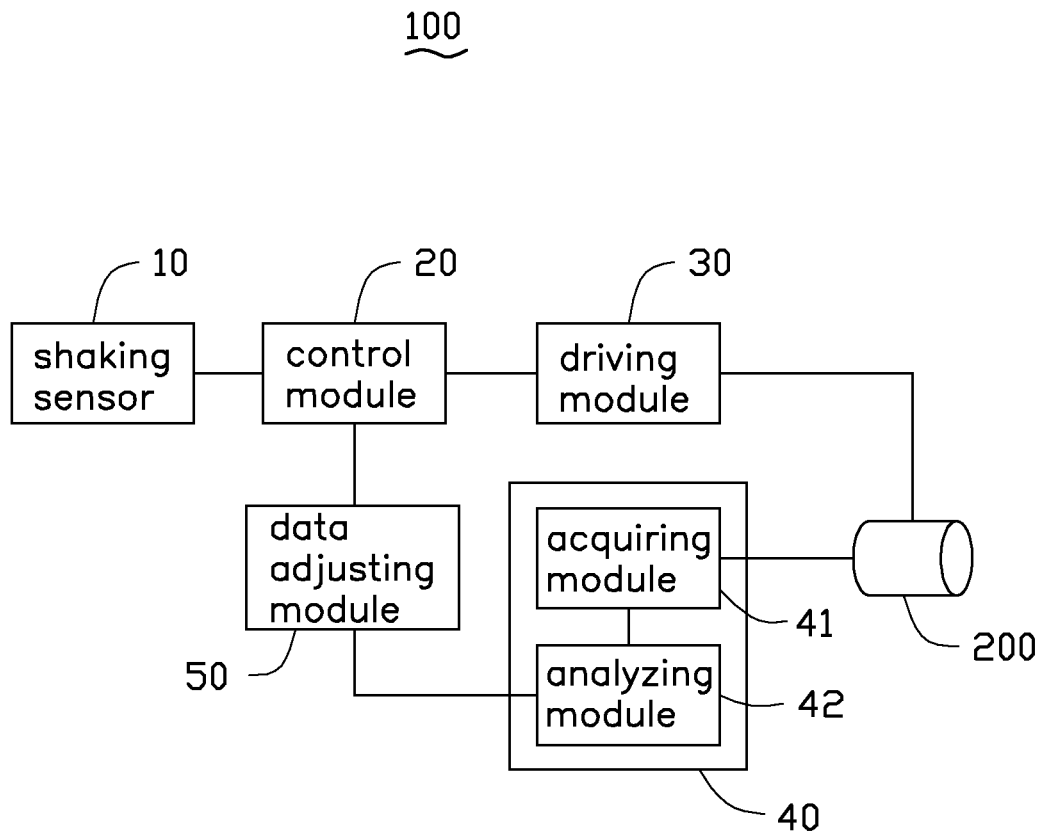


FIG. 1

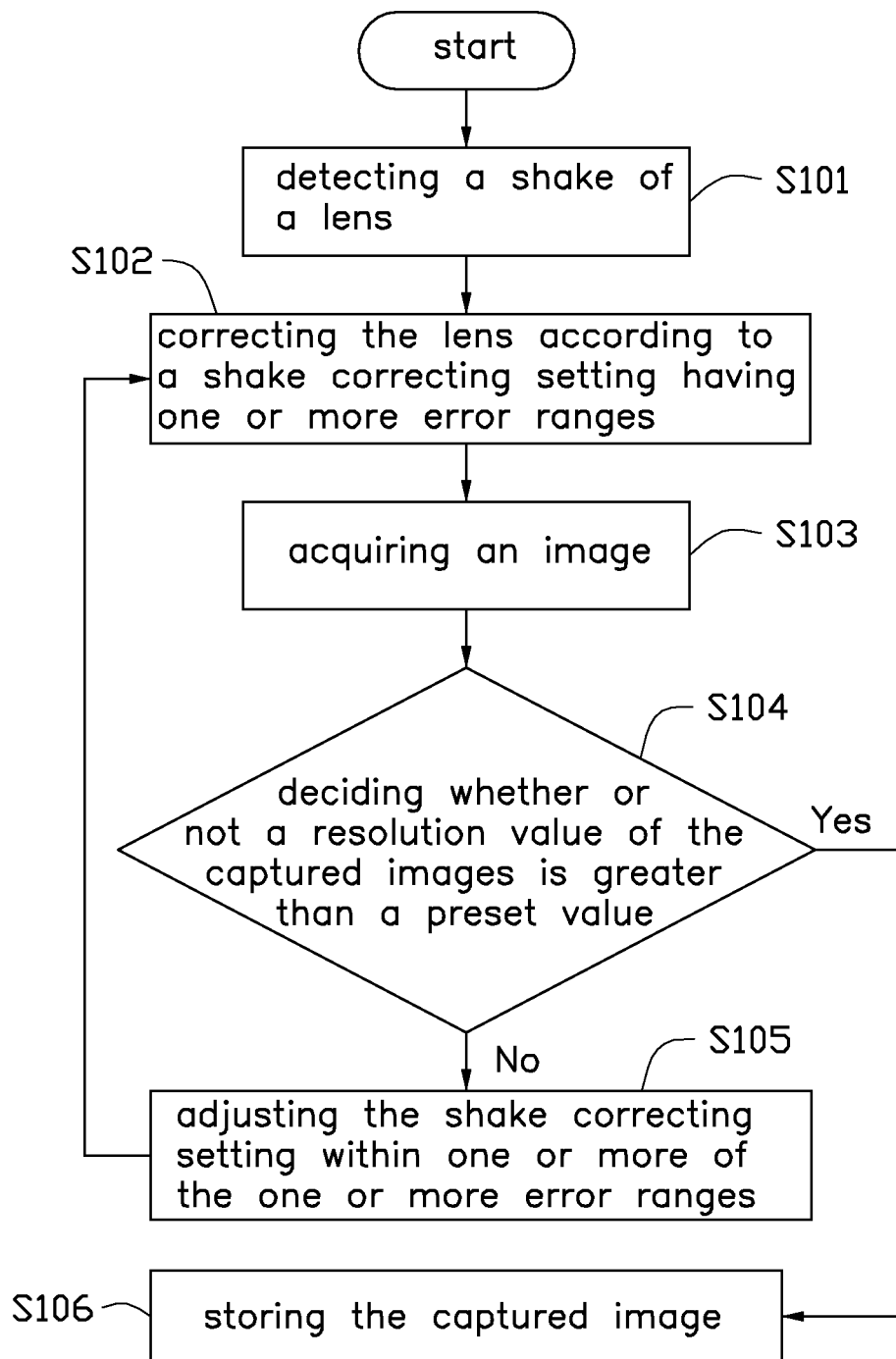


FIG. 2

IMAGE STABILIZER AND IMAGE-SHAKE CORRECTING METHOD

BACKGROUND

1. Technical Field

The present disclosure relates to image capturing and image-shake correcting technologies, and particularly to an image stabilizer and an image-shake correcting method.

2. Description of Related Art

Image stabilizers generally include a sensor fixed to a lens and a driving module configured for driving the lens to move to compensate for shaking of a camera during exposure according to signals outputted from the sensor. To ensure sensitivity and accuracy of the sensor, the sensor is typically complicated and of high precision, thus increasing the cost of the image stabilizer.

Therefore, it is desirable to provide an image stabilizer and a related method which can overcome the limitations described.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of an image stabilizer in accordance with an exemplary embodiment.

FIG. 2 is a flowchart of an image-shake correcting method in accordance with an exemplary embodiment.

DETAILED DESCRIPTION

Embodiments of the disclosure will be described with reference to the drawings.

In general, the word “module,” as used herein, refers to logic embodied in hardware or firmware, or to a collection of software instructions, written in a programming language such as Java, C, or assembly. One or more software instructions in the modules may be embedded in firmware, such as in an erasable-programmable read-only memory (EPROM). The modules described herein may be implemented as either software and/or hardware modules and may be stored in any type of non-transitory computer-readable medium or other storage device. Some non-limiting examples of non-transitory computer-readable media include compact discs (CDs), digital versatile discs (DVDs), Blu-Ray disks, Flash storing systems, and hard disk drives.

Referring to FIG. 1, an image stabilizer **100**, according to an exemplary embodiment, is configured for compensating for shaking of a lens **200** during exposure. The image stabilizer **100** includes a shaking sensor **10**, a control module **20**, a driving module **30**, an image module **40**, and a data adjusting module **50**.

The shaking sensor **10** is configured for detecting a shake of the lens **200** and outputting a shaking signal according to the shake. In the embodiment, the shaking sensor **10** is a gyroscope. The shaking sensor **10** and the lens **200** are assembled in an electrical device (e.g., a camera or a cell phone with a camera module, not shown) that uses the image stabilizer **100**. The shaking sensor **10** and the lens **200** are physically separate from each other. The shaking sensor **10** is also used to detect a rotation angle of the electrical device, and images displayed on a screen of the electrical device are rotated according to the rotation angle detected by the shaking sensor **10**.

The control module **20** is electrically connected to the shaking sensor **10**, and receives the shaking signal. A shake correcting setting is stored in the control module **20**, and the shake correcting setting is composed of an X-axis datum, a

Y-axis datum, and a Z-axis datum, such as (1, 1, -2) respectively. The unit of each datum is millimeters (mm). Each datum of the shake correcting setting has an error range, such as ± 0.1 mm. Generally, when a user presses a button of the electrical device to capture an image and while pressing the button shakes the electrical device, the amount and the direction of the shake remain unchanged. The shake correcting setting stored in the control module **20** can be used to effectively correct the shake of the lens **200**. Also, when the environment is changed, the lens **200** can be compensated by the shake correcting setting (see below).

The driving module **30** is electrically connected to the control module **20**, and is physically coupled to the lens **200**. The driving module **30** drives the lens **200** to move according to the shake correcting setting output from the control module **20**. In the embodiment, the driving module **30** includes a motor and a gear group connected to the motor. The motor is electrically connected to the control module **20**, and the gear group is physically coupled to the lens **200**.

The image module **40** includes a capturing module **41**, and an analyzing module **42** connected to the capturing module **41**. The capturing module **41** converts the light rays penetrating the lens **200** into image signals, and thus captures an image. The analyzing module **42** analyzes the image captured by the capturing module **41**, and compares a resolution value of the image with a preset reference value, such as **800**. The analyzing module **42** outputs different controlling signals according to a result of the comparison. In the embodiment, the capturing module **41** is a complementary metal-oxide semiconductor sensor. When the actual resolution value, such as **810**, is greater than or equal to the preset reference value, the analyzing module **42** outputs a first controlling signal. When the actual resolution value, such as **750**, is lower than the preset reference value, the analyzing module **42** outputs a second controlling signal.

The data adjusting module **50** is connected between the control module **20** and the analyzing module **42**. The data adjusting module **50** pre-stores an adjusting manner of the X-axis datum, then the Y-axis datum, and lastly the Z-axis datum. The adjusting manner is typically a protocol. For example, the adjusting protocol may include the following sequential steps carried out if and as needed: adjust the X-axis datum by gradually increasing or decreasing the X-axis datum within the corresponding error range, then adjust the Y-axis datum by gradually increasing or decreasing the Y-axis datum within the corresponding error range, then adjust the Z-axis datum by gradually increasing or decreasing the Z-axis datum within the corresponding error range, until the resolution value of another image captured by the capturing module **41** is less than the preset reference value. It should be understood that in other examples, the data adjusting module **50** can adjust the X-axis datum, the Y-axis datum, and the Z-axis datum according to other adjusting protocols.

In use of the image stabilizer **100**, the user presses the button of the electrical device to capture the image. The shaking sensor **10** detects a shake of the electrical device, and outputs a shaking signal to the control module **20**. The control module **20** outputs the shake correcting setting to the driving module **30**. The driving module **30** drives the lens **200** to move according to the shake correcting setting. The capturing module **41** captures the image through the lens **200** after the lens **200** is corrected. The analyzing module **42** analyzes the image captured by the capturing module **41**, and compares the resolution value of the image with the preset reference value. If the analyzing module **42** outputs the first controlling signal to the data adjusting module **50**, the control module **20** stores the image captured by the capturing module **41**. On the other

3

hand, if the analyzing module 42 outputs the second controlling signal to the data adjusting module 50, the data adjusting module 50 adjusts the shake correcting setting within one or more of the error ranges according to the adjusting protocol. Then the driving module 30 drives the lens 200 to move according to the adjusted shake correcting setting. Then the capturing module 41 captures the image through the lens 200 after the lens 200 is corrected.

Referring to FIG. 2, an image-shake correcting method, according to an exemplary embodiment, is used in the electrical device. The image-shake correcting method includes steps S101-S106.

S101: detecting a shake of the lens 200.

S102: correcting the lens 200 according to a shake correcting setting having one or more error ranges. In the above-described embodiment, the shake correcting setting is composed of the X-axis datum, the Y-axis datum, and the Z-axis datum. Each datum of the shake correcting setting has an error range, therefore there is a total of three error ranges.

S103: capturing an image through the lens 200 after the lens 200 is corrected.

S104: deciding whether or not a resolution value of the captured image is greater than a preset reference value.

S105: when the resolution value is lower than the preset reference value, the shake correcting setting is adjusted within one or more of the one or more error ranges. In the above-described embodiment, one or more of the X-axis datum, the Y-axis datum and the Z-axis datum is adjusted within the corresponding error range according to the adjusting protocol. Then the procedure returns to step S102.

S106: when the resolution value is greater than the preset reference value, the captured image is stored.

Particular embodiments are shown and described by way of illustration only. The principles and the features of the present disclosure may be employed in various and numerous embodiments without departing from the scope of the claimed invention. The above-described embodiments illustrate the scope of the disclosure but do not restrict the scope of the disclosure.

What is claimed is:

1. An image stabilizer, comprising:

a shaking sensor detecting a shake of a lens associated with the image stabilizer;

a control module storing a shake correcting setting having one or more adjustable error ranges, and electrically connected to the shaking sensor;

a driving module electrically connected to the control module and physically coupled to the lens, wherein the driving module is controlled by the control module to move the lens according to the shake correcting setting and thereby correcting a position of the lens;

an image module capturing an image through the lens; and
a data adjusting module electrically connected between the control module and the image module, and adjusting the shake correcting setting within one or more of the one or

4

more adjustable error ranges when a resolution value of the captured image is lower than a preset reference value;

wherein the control module further controls the driving module to move the lens according to an adjusted shake correcting setting adjusted by the data adjusting module, and thereby further correcting the position of the lens.

2. The image stabilizer of claim 1, wherein the shaking sensor and the lens are physically separate from each other.

3. The image stabilizer of claim 1, wherein the image module comprises a capturing module and an analyzing module connected to the capturing module; the capturing module converts light rays penetrating the lens to image signals, and captures an image; and the analyzing module analyzes the image captured by the capturing module, and compares the resolution value of the image with the preset reference value.

4. The image stabilizer of claim 3, wherein when the resolution value is greater than or equal to the preset reference value, the analyzing module outputs a first controlling signal to the data adjusting module, and the control module stores the image captured by the capturing module.

5. The image stabilizer of claim 3, wherein when the resolution value is lower than the preset reference value, the analyzing module outputs a second controlling signal to the data adjusting module, and the data adjusting module adjusts the shake correcting setting.

6. The image stabilizer of claim 5, wherein the shake correcting setting comprises an X-axis datum, a Y-axis datum, and a Z-axis datum, and the one or more error ranges are three error ranges, which are an X-axis datum error range, a Y-axis datum error range, and a Z-axis datum error range.

7. An image-shake correcting method, comprising:

detecting a shake of a lens;

correcting a position of the lens according to an adjustable shake correcting setting or a pre-stored shake correcting setting having one or more adjustable error ranges;

capturing an image through the lens after the position of the lens is corrected;

deciding whether or not a resolution value of the captured image is greater than or equal to a preset reference value; and

when the resolution value is lower than the preset reference value, adjusting the pre-stored shake correcting setting within one or more of the one or more adjustable error ranges.

8. The image-shake correcting method of claim 7, further comprising, when the resolution value is greater than the preset reference value, storing the captured image.

9. The image-shake correcting method of claim 7, further comprising, after the pre-stored shake correcting setting is adjusted, correcting the position of the lens according to the adjusted shake correcting setting, and again capturing an image through the lens.

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